BIOLOGICAL FARMING SYSTEMS ~ *'Macintyre Downs'* Experience

Macintyre Downs is a 3500 hectare irrigation property along 15km of the northern side the Macintyre River, bordering NSW, west of Goondiwindi. As a family cotton growing business, our goals have always been to maximise profit with the best management we knew to employ. We have, as a result found ourselves now developing a system of management which takes us towards our goals for healthy profitable farming, which could be labelled as 'Biological'. Becoming Biological Farmers was certainly not on our To Do list, whereas finding better ways to farm certainly was after some disappointing results with traditional management systems. The catalyst for us, in terms of investigating alternatives practices, was the aftermath of a particularly torrid cotton season in the late 90's, in which we were forced to re-evaluate practices after what we would consider unsustainable insect pressures and associated chemical use.

Biological farming means many things to many people, with a huge diversity of opinion evident about the correct recipe to follow for successfully achieving it. The term 'Biological farmer', appears to apply to everything from hippies in the hills without a clue to sophisticated leading edge growers, with varied philosophy and practices. For ourselves, we have come to the conclusion that Biological Farming is all about *process* and *outcomes*, rather than recipes or products. Invariably, the content of biological farming works in one situation and not another, for any of a number of interrelated and seemingly impossible to understand reasons, for the simple reason that soil is an incredible integrated living system, where simple cause and effect are hard to identify easily with reductionist science. For this reason, the recipes don't always seem to work, which makes the real job to understand the principal of why something worked, and how to transfer it.

The goal for us has been to go out and find the best we can find amongst other growers, in whichever crop or region they are and see what has been successful, trying all the while to take the Principle with us, not the product name. If you were to identify the single biggest cause of frustration and disappointment in growers who have tried something Biological, it is in the habit we all have of repeating the *practice*, without being clear on the *principal* at play.

We have discovered along the way there is relatively little Intellectual Property out there with direct respect to Biological farming methods which people could grab and employ in a bankable manner. For this reason, we have accepted the fact that whilst we can learn from others, we needed to have a go ourselves, inevitably make mistakes, have some wins and learn from each so that we achieved constant improvement. The alternative was to wait 4 to 5 years for convention to catch up to innovation, which was not an option. As such, our conscious decision was to become steadfastly committed to learning and developing reliable management practices resulting in our farm ecosystem being as healthy and productive as physically possible.

So what is Biological Farming? For us, the goal is a farming system with measurable biological health, *resilience* to external factors of drought and climate, and the capacity to outperform traditional 'fertilise and spray' farming. Combined, we find this management provides to us measurable *outcomes* in the form of benchmark goals for ROAM (returns on assets managed) and profitability whilst not just maintaining, but actually improving the quality of our asset (soil/water ecosystem) beyond the short term.

In terms of detail, it is simplest to break our farming system down into simplified Goals, the How and Outcomes.

Goals	1. Increased Water Use Efficiency (WUE) 2. Increased Nutrient Cycling, or fertiliser efficiency 3. Reduced $/Ha on chemical.

HOW	WUE • Use of bulk organic matter blends, including compost, humates, slow release phosphates and soluble nitrogen, inoculated with beneficial species of bacteria and fungi to raise soil levels. • Green manure crops over winter, using vetch/oats, with the goal of minimising fallow and *creating* a significant amount of organic matter to raise soil levels. • Use of compost and manure to physically import organic matter. • Application of lime and gypsum to raise base saturation of calcium and lower exchangeable sodium. • Use of liquid limes/gypsum products.
	Nutrient Cycle Efficiency • Green manure crop to produce stable nitrogen from legume over winter and stimulate all nutrient cycling via microbial energy after incorporation. • Use of stimulants with fertiliser to boost microbial activity in the root zone, such as humic acid, sugars and kelp. • Addition of beneficial biology in the form of inoculum made from compost and commercial sources to saturate the root zone with beneficials. • Investigate different *forms* of nutrients required o Sulphate of ammonia for acidity and sulphur o Urea with humic acid to increase efficiency o Compost for organic NPK o Rock phosphate, Guano and liquid inject phosphate in place of traditional starter o Foliar programs with calcium, carbohydrates and trace elements to boost plant nutrition o Foliar nitrogen with humic acid to allow greater nitrogen rates per hectare Very simply, the fertiliser budget has evolved to now be split three ways, with emphasis depending on crop, field history and performance, to cover each of: o Plant nutrition o Soil chemistry imbalance, ie calcium or organic matter o Soil biology Every opportunity is taken to apply plant, soil or microbial stimulant during the year, within fertiliser, seed treatments at planting, within stubble management, water run irrigation and weed control.
	$/Ha Chemical • Use of strip cropping, with rows alternated each season, to maximise ecosystem bio-diversity within a field to remove monoculture and disrupt soil and air borne insect pressures by condensing a 2-3 year rotation into a single season. • Use of Fulvic acid and organic buffers with herbicide and foliar nutrient sprays to increase efficiency. • Relatively low nitrogen applications rates applied more often with humic acid to buffer against high plant nitrate levels and insect pressures. • Use of IPM and release of predatory species, eg *Trichogamma.*

OUTCOMES	WUE • Progressive and obvious softening of soil structure physically such that reduced cultivation for preparation is required, ie 1-2 less workings per year. $ value of this of $80-100/ha • Crop stress reduced in low water seasons, with plants lasting out to 16 days between waters compared to 10-11 days. The result of this was premiums for quality in 2002/03 when dockages were common in the valley, due to dropping irrigations at critical time. For example, our Field 1 conventional cotton yield 4.2 bales/ac with two irrigations dropped resulting in crop use of 5.9ML/ha. • Soil chemistry improved, with lowered pH, notwithstanding use of *Lime*, and improvements in water infiltration. • Organic matter levels increased.
	Nutrient Cycling Efficiency • Initial budgets for fertiliser were increased to meet goals for higher crop nutrition and soil health, which has been off-set by reduced insecticide costs. • Soil profile (0-60cm) Nitrogen budgets have shown increased nitrogen retention and efficiency with the use of humic acid against controls. • Timing of green manure cycle is critical to nutrient supply to subsequent crop, particularly Nitrogen as would be expected o Overall gross margin comparisons between green manure and traditional fallow came out approximately equal, when all associated costs of cultivation, labour, etc., are included, with the benefit being improved soil quality. Longer term benefits still not quantified. • Practice beats theory in all cases. A variety of products which should theoretically mix successfully as foliar sprays or starter fertiliser, for example, have become expensive lessons in Vegemite production. • A program of repeated foliar sprays with nutrient and carbohydrate resulted in the highest quality (as measured by volumetric test weights) sorghum grown in the valley according to buyers. Results were 20% higher than previous test weights on Macintyre Downs. • Moving away from traditional nitrogen and Starter fertiliser *requires* good decision making and is less convenient.
	$/Ha Chemical • Where alternate strip cropping has been going three seasons, the trend of insecticide costs is clearly downwards, with $67/ha achieved in 2003/04 season for conventional cotton. • Herbicide efficiency has been improved since moving to fulvic acid in most sprays. Replicated trials have evidenced we can drop rates by 20-30% and maintain efficacy. • Severity of the chemical used across the farm has lowered over the past four years, although in this past season we used more chemical than in the previous three years. • Diesel use per hectare has decreased as soils have softened and require less energy to prepare for planting. • Enjoyment factor in farming has increased with reduced chemical and increased sense of potential.

The above is obviously a very brief summary of six years trial and error conducted on just our farming business, recognising we are not a research institution and endeavouring to be as profitable and resilient to conditions as possible.

On reflection, the absolutely critical question to us is whether the efforts have been worth it, given the lack of water and tough seasons recently. We are firmly convinced they are and that we are better positioned now to leverage good seasons as they arise. As for any business serious about being successful and sustainable, we need to question the assumptions inherent in management. To this end, the question needs to be asked…

Is Biological farming a philosophical decision by growers or a sound business strategy of business owners?

The answer depends on whether Biological Health has an economic value?

The experience of Macintyre Downs is that if there is not economic value to the business, the system will fail, irrespective of its feel good factors.

Sustainability absolutely depends on profitability.

Simple concept, difficult reality.

Where such analysis becomes difficult is in the realisation that the total Biological package is more than the sum of its individual parts.
In reviewing the past few years management, it is clear that in isolation, relatively few of the products or practices individually employed have provided an immediate economic advantage over its traditional alternative, nor has it been easy to *immediately* see the impact of most changes implemented. The majority of the practices we now consider essential would have been culled as time wasters and expensive based on the results of single first year analysis, as it has often taken a season or two for flow-on effects of soil improvement to become evident in nutrient cycling, water use or insect pressure. This tends to run contrary to our cultural need for instant gratification, which is reflected in the majority of quick fix products on the market.

Having persisted and maintained our commitment to our goals we have certainly found the whole package, or biological approach to management, has built on itself with subtle cumulative shifts each year in soil quality, crop response and the impact of external influences such as insects, water availability, etc. The result is that we strongly believe there is a measurable economic value to us in Biological farming, evident as maintained or higher yield and improved quality achieved whilst *also* visually improving the soil and ecosystem we farm.

In summary, we believe if our economic return on capital can be increased, whilst also improving the productive capacity of the resource base which provides it, then logically we should be better positioned to farm successfully in future seasons and more able to mitigate the impact of drought, rising water and fertiliser costs, and other off farm influences. This ultimately represents our goal for sustainable enjoyable farming.

Written by
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